REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

THE REJECTIONS UNDER 35 U.S.C. § 112

Claims 1-22 had been rejected under Section 112, second paragraph, as allegedly being indefinite. These rejections are respectfully traversed, particularly as applied to the claims as presently amended.

Amendments have been made to claims 1 and 16 to address the Examiner's concerns that these claims are indefinite. Independent claim 16 and the subsequent dependent claims 17-21 were indicated allowable over the prior art. Applicant thanks the Examiner for this indication of allowability. Since the rejection of claim 16 under Section 112 has been addressed with the present amendment, it is respectfully submitted that claims 16-21 are allowable in their current form. Favorable consideration is therefore respectfully requested.

Claim 22 has been amended to delete the words "at infrequent intervals" so as to remove the apparent contradiction between "at infrequent intervals" and "sufficiently large". The requirement in subsection (d) of claim 22 that the number of antennas be sufficiently large to satisfy the unique maximum criterion implies that the linear independence criterion has been met. As such, this deletion does not introduce any new subject matter into the claims.

The other amendments to claim 22 in (c) and (d) address the examiner's concern that the recited "covariance matrix" is indefinite due to lack of antecedent basis as well as not being previously determined or obtained. As currently recited, subsection (c) of claim 22 now precisely defines how the covariance matrix is determined, and the currently recited subsection (d) of claim 22 shows

how this relates to determining whether the antenna array meets the functional requirements of the invention.

The preamble of claim 22 has been amended so as to clarify that the scope of this claim is within the scope of the other independent claims by requiring that the antenna area be for locating transmitters and not simply detecting them – this wording is also made more precise by defining the carrier frequency of the transmitters. Thus, it is respectfully submitted that this amendment satisfies the Examiner's requirement that claim 22 be required to conform with the other independent claims. Reconsideration and withdrawal of the above-indicated rejections under Section 112 is respectfully requested.

THE REJECTIONS UNDER 35 U.S.C. § 103

Claims 1-15, 22-23 had been rejected under Section 103(a) as being unpatentable over Wax al. (U.S. Pat. No. 6,104,344) in view of Kuwahara (EP 0 932 049) and Michal et al. ("Multiple Target Detection for an Antenna Array Using Outlier Rejection Method.") These rejections are respectfully traversed, particularly as applied to the claims as presently amended.

In light of the Wax et al., Kuwahara and Michal et al. references, it should be noted that the present claims include notable limitations that cannot be found in any of these references and would not be obvious to a person skilled in the art at the relevant time. A key limitation in all the independent claims is the creation of a hypothetical grid size of less than or equal to 1/8 of a wavelength so that a unique location of $\pm\frac{1}{4}$ of a wavelength can be achieved without the need to perform manual calibration of the phase angle of arrival information in the search area.

This result can be achieved by the use of signatures of hypothetical signals across proximate grid points, as is the case of claim 16 and dependent claims therefrom, as indicated allowable by the Examiner. This result can also be achieved by taking each grid point separately and using a sufficient number of antennas to ensure linear independence of the library of manifold vectors, as is

recited in claims 1, 8 and 22. However, the present invention contains at least another limitation that does not appear in any of those references and would not be obvious to a skilled artisan at the relevant time.

With respect to the claims at issue, the prior art does not appreciate that each point in a sufficiently fine virtual grid has a unique manifold vector with respect to a random antenna array having a sufficiently large number of antennas. To satisfy this uniqueness criterion, the number of antennas can be increased until the noise subspace in the region of interest is rank full. This system is sufficient to yield very high accuracy without the need to manually calibrate the search parameters at each point within the area of interest.

It should be carefully noted that none of the devices shown in the Wax et al., Kuwahara or Michal et al. references create a library of manifold vectors based on hypothetical signals originating from grid points of 1/8 of a wavelength. Similarly, none of the devices shown in Wax et al., Kuwahara or Michal et al. include a fine point sampling of less than 1/8 of a wavelength to reach the Nyquist criterion for the spacial sampling. Further, the grid in Wax et al. is manually calibrated, which may be necessary in grids with large spacing or few antennas, but this requirement is eliminated by the present invention.

Applicant respectfully disagrees with the Examiner's opinion that reducing the size of sub-bins to 1/8 of a wavelength would have been obvious to the skilled artisan on the basis of the art quoted. It should be noted that the uniqueness of location criterion cannot be established without a grid resolution of 1/8 of a wavelength and a rank full library of manifold vectors for the noise subspace of the antenna array.

In Wax et al., a practitioner relying on the time of arrival information (as recited in the present claims) would easily make a number of false positive identifications by relying on bin sizes that are too large to generate the unique result, or an insufficient number of antennas. Such a practitioner would be forced to backtrack in the location process and re-evaluate the grid sizing at each step, and either add antennas or abandon the search. However, in the method and

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system of the current invention, the location algorithm produces a unique result in a single iteration.

It should also be noted that the cited references relied upon by the Examiner, taken alone or in combination, would result in a location scheme that would require manual calibration of the search area. Manual calibration of the search area to a resolution of less than 1/8 of a wavelength is impractical if not practically impossible, given the subject matter disclosed in the cited references. Since these prior art methods require manual calibration, the present invention realizes a substantial improvement over the prior art. It is therefore respectfully submitted that the claimed limitations, particularly those recited presented in claims 1, subsection (b), claim 8, subsection (c), and claim 22, subsection (b) as amended are not present in the prior art, and are sufficient to overcome the Examiner's non-obviousness threshold. Reconsideration and withdrawal of these rejections are respectfully requested.

The invention does not make any claims to outlier rejection techniques, as disclosed in Michal et al. The outliers previously referred to in one of the claims were not used for rejection purposes, but were selected as the probable transmitter locations. To avoid this confusion, claim 22 has been amended to replace the word "outlier" with the word "maximum." Reconsideration and withdrawal is respectfully requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. DWW-14908.

Respectfully submitted,

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